Alfalfa Leaf Meal: Use as a Source of Supplemental Protein

M.A. Jorgensen, J.-M. Akayezu, J.G. Linn and H.G. Jung

Introduction

As described in the previous report by Akayezu et al. (this volume), alfalfa leaf meal (ALM) is potentially a new feed ingredient for use by the dairy industry. Alfalfa leaves contain approximately 30% crude protein (CP) and 25% neutral detergent fiber (NDF). This composition suggests that ALM might be a useful supplemental protein feed for lactating dairy cows. Our initial research indicated that ALM can partially substitute for alfalfa hay in lactation diets. The objective of this study was to determine if ALM could replace soybean meal as a supplemental protein in lactating cows.

Materials and Methods

Twenty multiparous Holstein cows were used in a replicated 4 x 4 Latin square design. Cows were grouped based on days in milk, milk yield, and body weight. Within group, cows were randomly assigned to one of four treatments. Treatments consisted of a control diet (ALM0) in which soybean meal (SBM) was the main source of supplemental protein, and three diets containing ALM formulated to contain 11 (ALM11), 22 (ALM22), or 33 (ALM33) % of the total dietary CP from ALM, in replacement of SBM. In ALM0, SBM constituted about 24% of the total CP in the diet. For diets ALM11, ALM22, and ALM33 the SBM contribution decreased to 17, 9, and 0% of total dietary CP. The ALM used in this study was in meal form and contained 22.4% CP and 39.5% NDF. The composition of the experimental diets is given in Table 1. Diets were fed as total mixed rations. Cows were fed twice daily, ad libitum, and milked twice daily. Periods consisted of 14 d for adaptation and 7 d for sample collection. Measurements were taken for nutrient intake, and milk yield and composition.

Results and Discussion

When ALM supplied 0, 11, 22, or 33% of the total dietary CP, then diet DM contained 0, 7.5, 14.6, and 23.5% ALM, respectively. Dry matter intakes (DMI) of cows decreased linearly as ALM content increased in the diet (Table 2). Despite decreases in DMI, the yield of milk or fat-corrected milk from cows fed ALM were similar to those cows fed ALM0 (Table 3). Milk composition was not affected by treatment except milk protein percentage, which was slightly reduced when ALM supplied 22% of dietary CP, compared with the ALM0 diet. In this study, the lack of treatment effect on milk yield, along with decreased DMI, as ALM is increased in the diet suggests that cows fed diets containing ALM were more efficient in converting nutrients into milk and milk components. However, in this short-term study, it is impossible to detect if cows were, in fact, drawing on body reserves to maintain milk production while decreasing intake. A longer lactation trial would be required to determine if ALM fed cows were truly more efficient.

Conclusion

The results from this trial indicate that ALM can provide supplemental protein in lactating cow diets. Whether the improved efficiency of milk production compared to SBM-based diets for ALM fed cows can be sustained over a full lactation is unclear. It must be noted that the ALM available for this study was lower in quality (lower protein, higher fiber) than could be anticipated based on the quality of alfalfa leaves. As the separation technology for producing ALM matures it might be expected that the protein concentration of the ALM could be raised. Such a change should make ALM a more attractive supplemental protein source.

Table 1. Composition of experimental diets.

	Diet			
Item	ALM0	ALM11	ALM22	ALM33
Ingredient Composition	- - - - - - - - - - % of diet DM - - - - - - - - —			
Hay	17.3	17.5	17.4	14.5
Corn Silage	32.0	32.9	32.7	26.9
Grain Mix	50.7	49.6	49.9	58.6
Chemical Composition[1]				
DM	58.7	58.3	58.6	62.7
CP	16.3	15.9	16.0	15.9
NDF	31.8	35.4	37.2	34.3
ADF	15.2	17.1	19.4	18.0

[1]DM (dry matter), CP (crude protein), NDF (neutral detergent fiber), and ADF (acid detergent fiber).

Table 2. Effect of diet on nutrient intake.

	Diet					
Item	ALM0	ALM11	ALM22	ALM33	SE	P
	- - - - - - - - - - - - kg/d - - - - - - - - - - - -					
DM	27.6[a]	26.9[ab]	26.4[b]	25.8[b]	.44	.05
CP	4.5[a]	4.3[b]	4.3[b]	4.1[b]	.07	<.01
NDF	8.8[c]	9.3[b]	9.9[a]	9.0[bc]	.16	<.01

[abcd] Means in the same row with no common superscripts differ (P < 0.05)

Table 3. Effect of diet on milk yield and composition.

	Diet					
Item	ALM0	ALM11	ALM22	ALM33	SE	P
Milk, kg/d	34.5	33.9	34.1	34.1	.64	.91
FCM[1], kg/d	36.5	36.4	36.6	35.5	.66	.45
Fat, kg/d	1.3	1.3	1.3	1.3	.03	.27
Protein, kg/d	1.1	1.1	1.1	1.1	.02	.21
Lactose, kg/d	1.6	1.6	1.6	1.6	.03	.73
Fat, %	3.9	3.9	4.0	3.8	.07	.23
Protein, %	3.2[a]	3.2[a]	3.1[b]	3.1[ab]	.02	.05
Lactose, %	4.6	4.6	4.6	4.6	.02	.81

[1]FCM = 3.5% fat-corrected milk.

[ab]Means in the same row not sharing superscripts differ (P < 0.05).